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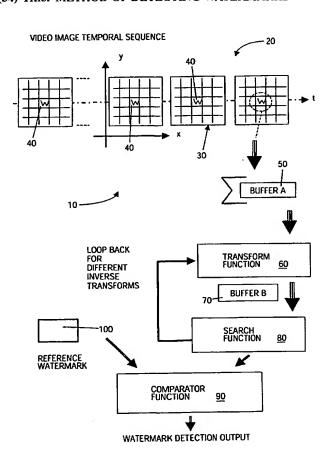
- (71) Applicant (for all designated States except US): KONIN-KLIJKE PHILIPS ELECTRONICS N.V. [NL/NL]; Groenewoudseweg 1, NL-5621 BA Eindhoven (NL).
- (72) Inventors; and
- (75) Inventors/Applicants (for US only): VAN VUGT, Henricus, A., G. [NL/NL]; c/o Prof. Holstlaan 6, NL-5656

AA Eindhoven (NL). VAN GESTEL, Henricus, A., W. [NL/NL]; c/o Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).

- (74) Agent: SCHMITZ, Herman, J., R.; Prof. Holstlaan 6, NL-5656 AA Eindhoven (NL).
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(54) Title: METHOD OF DETECTING WATERMARKS



(57) Abstract: It is difficult to detect a watermark (40) in a video image sequence (20) if the image has been subjected (possibly by a hacker) to affine transforms such as scaling, rotation, flipping, etc. The transform carried out is generally unknown. Therefore, one or more inverse transforms (60) are performed to the image prior to detection (90) until a reliable decision can be made. The inverse transforms are performed with small stepsize variations of adequate parameters. In a preferred embodiment, an initial search for correlation is done between the inverse transformed image an a blurred version of the reference watermark, the blurred reference watermark being obtained by combining a number of e.g. rotated versions of the reference watermark. If some correlation has been found, the amount of blur and/or the stepsize is decreased. This requires fewer steps to detect the watermark.

Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD,

SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

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A. CLASSIFICATION OF SUBJECT MATTER IPC 7 G06T1/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUME	ENTS CONSIDERED TO BE RELEVANT	
Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6 408 082 B1 (RHOADS GEOFFREY B ET AL) 18 June 2002 (2002-06-18) claims 1-10 column 1, line 60 - column 2, line 11	1-3,6,7, 17-19, 21-23
Y	column 2, line 54 - line 62 column 3, line 44 - column 4, line 29 column 5, line 49 - column 6, line 62/	5,12-15

X Further documents are listed in the continuation of box C.	Patent family members are listed in annex.
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the International filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	 *T* later document published after the International filling date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. *&* document member of the same patent family
Date of the actual completion of the international search 15 September 2004	Date of mailing of the international search report 13/10/2004
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax. (+31–70) 340–3016	Authorized officer Delítorn, J-M

lonal Application No IB2004/050385

•	tion) DOCUMENTS CONSIDERED TO BE RELEVANT	Polyant to claim No.
ategory °	Citation of document, with Indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PEREIRA S ET AL: "ROBUST TEMPLATE MATCHING FOR AFFINE RESISTANT IMAGE WATERMARKS" IEEE TRANSACTIONS ON IMAGE PROCESSING, IEEE INC. NEW YORK, US, vol. 9, no. 6, June 2000 (2000-06), pages 1123-1129, XP000951913 ISSN: 1057-7149 page 1125, section III - page 1127, left column, line 42	1-4,6-8, 11,17, 21-23
•		
Y	LIN CY. ET AL.: "rotation, scale and translation resilient watermarking for images" IEEE TRANSACTION ON IMAGE PROCESSING, vol. 10, no. 5, May 2001 (2001-05), pages 767-782, XP002296325 page 769, section II.A -page 770, left column, line 6	1-3,6-8, 17,21-23
X	HARTUNG F ET AL: "SPREAD SPECTRUM WATERMARKING: MALICIOUS ATTACKS AND COUNTERATTACKS" PROCEEDINGS OF THE SPIE, SPIE, BELLINGHAM, VA, US, vol. 3657, 25 January 1999 (1999-01-25), pages 147-158, XP000949145 ISSN: 0277-786X page 154, section 4.4 - page 156, line 1 page 150, section 3.2 - page 151, line 42	1-3,6-8, 12-15, 17,21-23
Υ	GB 2 371 435 A (IBM) 24 July 2002 (2002-07-24) claims 8-10 page 4, line 20 - page 5, line 11 page 7, line 20 - page 9, line 3 page 9, line 21 - line 34	1-3,6-8, 17,21-23
Y	FRIDRICH J ET AL: "COMPARING ROBUSTNESS OF WATERMARKING TECHNIQUES" PROCEEDINGS OF THE SPIE, SPIE, BELLINGHAM, VA, US, vol. 3657, January 1999 (1999-01), pages 214-225, XP000961847 ISSN: 0277-786X page 215, section 2 - page 219, line 1	12-15

onal Application No IB2004/050385

		182004/050385
C.(Continu	ation) DOCUMENTS CONSIDERED TO BE RELEVANT	
Category °	Citation of document, with Indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CHEN, Y-K.; HOLLIMAN, M.; DEBES, E.; ZHELTOV, S.; KNYAZEV, A.; BRATANOV, S.; BELENOV, R.; SANTOS: "Media Applications on Hyper-Threading Technology" INTEL TECHNOLOGY JOURNAL., February 2002 (2002-02), XP002296402 page 4, left-column, line 4 - page 5, left-column, line 11	5
A	WO 99/36876 A (DIGIMARC CORP) 22 July 1999 (1999-07-22) Abstract page 4, line 1 - line 14 page 5, line 14 - line 23 claims 1,6,11	18,19
A	KIM HS., BAEK Y. AND LEE HK.: "rotation-, scale-, and translation-invariant image watermark using higer order spectra" OPTICAL ENGINEERING, vol. 42, no. 2, February 2003 (2003-02), pages 340-349, XP002296403 page 342, section 3.1 page 347, section 5.1	1-3,6-8, 17,21-23

INTERNATIONAL SEARCH REPORT

Information on patent family members

onal Application No IB2004/050385

					2004/ 030303
Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 6408082	B1	18-06-2002	US	6122403 A	19-09-2000
00 0400002	-	20 00 -00-	US	5862260 A	19-01-1999
			US	5822436 A	13-10-1998
			US	2003039377 A1	27-02-2003
			ÜS	2004001608 A1	01-01-2004
			US	6424725 B1	23-07-2002
			US	2002090113 A1	11-07-2002
			US	2002164049 A1	07-11-2002
			US	2002186886 A1	12-12-2002
			US	2002186887 A1	12-12-2002
			US	2003033530 A1	13-02-2003
			US	2003093330 A1 2003091189 A1	15-05-2003
			US	2003053653 A1	20-03-2003
			US	2003033033 A1 2003102660 A1	05-06-2003
			US	2003102000 A1 2003086585 A1	08-05-2003
			US	2003080585 A1 2003142847 A1	31-07-2003
				2003142847 A1 2003128861 A1	10-07-2003
			US US	2003128601 A1 2003103645 A1	05-06-2003
			US	2003103645 A1 2004022444 A1	05-00-2003
			US	2004022444 A1 2003133592 A1	17-07-2003
			US	2003133592 A1 2004057581 A1	25-03-2004
			US	2003050961 A1	13-03-2004
				2003030301 A1 2003231785 A1	18-12-2003
			US	2004005093 A1	08-01-2004
			US		11-12-2003
			US	2003228031 A1	27-11-2003
			US	2003219144 A1	02-03-2004
			US	6700990 B1	23-10-2001
			US	6307949 B1	30-04-2002
			US	6381341 B1	02-09-2003
			US	6614914 B1	26-08-2003
			US	6611607 B1	20-05-2003
			US	6567533 B1	26-02-2004
			US	2004037449 A1	05-08-2004
			US	2004153649 A1	11-11-2003
			US	6647128 B1	01-07-2004
			US	2004128514 A1	06-09-2001
			US	2001019618 A1	23-08-2001
			US	2001016051 A1	24-01-2002
			US	2002009208 A1	17-01-2002
			US	2002006212 A1	21-02-2002
			US	2002021824 A1	
			US	2002067844 A1	06-06-2002
			US	2002118831 A1	29-08-2002
			US	2002090112 A1	11-07-2002
			บร	2002080997 A1	27-06-2002
			AU	3008697 A	05-12-1997
			EP	1019868 A2	19-07-2000
			MO	9743736 A1	20-11-1997
			US	2002188841 A1	12-12-2002
			US	6229924 B1	08-05-2001
GB 2371435	Α	24-07-2002	GB	2335816 A ,B	29-09-1999
4D 53/1433	~	L. 0, 2002	JP	3490332 B2	26-01-2004
			ĴΡ	11341452 A	10-12-1999
			TW	409214 B	21-10-2000
			ÜS	6785398 B1	31-08-2004
	-	22-07-1999	AU	747372 B2	16-05-2002

INTERNATIONAL SEARCH REPORT

information on patent family members

lonal Application No IB2004/050385

Patent document cited in search report	Publication date		Patent family member(s)	Publication date
WO 9936876 A		AU BR CA EP JP US US US US US US US US US US US	2463499 A 9907105 A 2318564 A1 1050005 A2 2003529225 T 2002061121 A1 2002064298 A1 9936876 A2 2002159615 A1 2002176600 A1 2002172397 A1 2002181735 A1 2003035565 A1 2003128861 A1 6427020 B1 2003231785 A1 6636615 B1 6574350 B1 6332031 B1	02-08-1999 30-04-2002 22-07-1999 08-11-2000 30-09-2003 23-05-2002 20-07-1999 31-10-2002 28-11-2002 21-11-2002 20-02-2003 10-07-2003 30-07-2002 18-12-2003 21-10-2003 03-06-2003 18-12-2001